



Editorial

Chinese zodiac results in distortion of sex ratio



The sex ratio [male/female (M/F)], which is defined as the ratio of males to females in a population, is assumed to be close to 1:1.¹ However, at birth, the sex ratio of males to females is approximately 105:100.² In some countries, and especially in ethnic Chinese societies,¹ a significant change and distortion of the sex ratio at birth have been reported.³ Dr. Grech⁴ has published an article in this issue addressing this topic in Hong Kong, and showed that the birth rate and sex ratio were both influenced by the Chinese zodiac (Shengxiao: a 12-year Chinese cycle with each year given an animal's name, from rat to pig). The main findings of Dr. Grech's⁴ study were: (1) the sex ratio at birth in Hong Kong showed peaks in Dragon years, including 1975–6, 1988, and 2000; (2) the sex ratio remained stable overall, within a relatively narrow range, except for a rise commencing in 2004; and (3) there was a slow decline in the total number of births that reversed in 2004. Dr. Grech⁴ suggested that the M/F ratio follows a U-shaped regression on cycle days of insemination; that is to say, female conceptions result from conceptions around ovulation, and male conceptions occur more frequently at the beginning and end of the menstrual cycle.⁴ In addition, families in Hong Kong attempting to have children during Dragon years may have increased coital rates, inadvertently skewing the sex ratio in favor of an excess of males.⁴ Although the explanation may be reasonable, some are not clear.

The first question is with regard to the frequency of coitus rates being related to the high birth rate. In some countries, this may be true, because there is an absence of effective contraception methods. However, many contraception methods are relatively advanced and highly accessible in modern societies, including Hong Kong, so it is not credible that higher coitus rates will result in higher pregnancy rates. In addition, conception is influenced by many nonbiological factors, such as economic, social, cultural, and ethical factors. For example, in Taiwan, the number of newborns has dramatically and progressively declined in recent years. No one believes that the decline in the number of newborns is secondary to a decreased coitus rate. Therefore, the change in birth rates cannot be explained simply by coitus rates.

Although it has been scientifically demonstrated that lunar cycles might have an important effect on several biological events, controversy exists regarding the lunar influence on

human and animal parturition.⁵ In fact, there is a large body of research on the variation of human sex ratios based on: (1) the time of insemination within the mother's fertile cycle; (2) the duration of gestation; (3) coital frequency, here called the "coital rate"; and (4) the amount of time taken to achieve conception within a period of risk (viz. in the absence of birth limitation methods).⁶ One study showed that the sex ratio was not statistically related to different lunar phases or days,⁵ although others favor the strong evidence that the offspring sex ratio varies with the time of conception within the cycle.⁶

The third question regards whether higher coitus rates inadvertently skew the M/F ratio in favor of an excess of males. James⁶ argued that the available data constitute evidence that the sex ratio varies with the coitus rate and with the time needed to achieve conception, although this variation is small, difficult to detect, and of no clinical significance.⁷

Therefore, it is hard to convince us that a dramatic change in the sex ratio, as the author said, is natural (related to coitus rates).⁴ By contrast, we believe that this distortion might be an end-product of medical approaches taken, or assisted reproductive technologies used.⁸ One study showed that intrauterine insemination, *in vitro* fertilization (IVF), and intracytoplasmic sperm injection (ICSI) led to different sex ratios, with the highest after IVF (proportion male = mean $0.521 \pm$ confidence interval 0.0056) and the lowest with ICSI embryo transfer (0.493 ± 0.0031).⁹ In addition, for both ICSI and IVF, transferring embryos at a later stage (blastocyst) results in approximately 6% more males than after early cleavage-stage embryo transfer.⁹ Much evidence supports the possibility that the distorted sex ratio might be secondary to sex-selective abortions that take place in population groups with certain ethnic and social profiles.^{10,11} With the advanced techniques used for prenatal diagnosis, including noninvasive¹² and invasive procedures,⁸ early identification of the offspring's sex is possible for the purpose of performing sex-selective abortions.

Conflicts of interest

The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

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